

### **Abstract**

This invention pertains to alarm condition fiber optic sensor with storage transmission-reflection analyzer for detection and localization of any number of consecutive loss-inducing disturbances along the test fiber. The sensor includes a test fiber having a first port and a second port; a light source for producing a beam of light propagating along the test fiber; a fiber optic beamsplitter having a first port connected to the light source, a second port connected to the first port of the test fiber, and a third and a fourth port; a plurality of reflectors positioned along the test fiber and a plurality of loss-inducing members positioned along the test fiber, wherein said each of the reflectors is matched to each loss-inducing members, wherein at least one reflector is placed between each consecutive loss-inducing members; an optical reflection detector to receive a light flux, the optical reflection detector connected to the third port of optic beamsplitter, wherein the reflection detector is adapted to sense changes in the average power of the light reflected from the reflectors; an optical transmission detector adapted to receive the light flux, connected to the second port of test fiber, said transmission detector being operable to sense changes in the average power of the light transmitted through the test fiber; and a storage transmission-reflection analyzer connected to reflection and transmission detectors, and adapted to measure time-behavior of the transmission-reflection dependencies of test fiber, said analyzer being operable to identify the locations and values of any number of consecutive loss-inducing disturbances along the test fiber by using stored locations and values of previous perturbations and the slope of dependence of normalized reflected average power versus the square of normalized

transmitted average power for current loss-inducing  
perturbation.